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Deliberating on renewable and sustainable energy policies in China

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A B S T R A C T

In order to realize the sustainable development of country and society, many countries have established their renewable energy law and development strategy no matter developed countries or developing countries. It is well known that China is the largest developing country in the world, and the per capita GDP ranks more than 100, however, the total GDP ranks the second due to the huge population amount, and just behind USA. Certainly, the total energy consumption amount is huge, and the big energy demand has brought a serious of environmental problems such as acid rain, water and soil pollution, and resource exhaustion, etc. Fortunately, China central government has regarded the serious question to realize the sustainable development in future. The renewable energy law has been established in 2005. Firstly, China's energy situation and existing environmental questions in past years is introduced in this paper. Secondly, the distribution and the application practice of different renewable energy were introduced. Then, China's renewable energy policy is detailed introduced in the following section. The next section discusses the existing questions. Based on these discussions, the development barriers and recommendations are introduced, respectively.

Contents

1. Introduction

At present, everybody will agree on the fact that future sustainable development of mankind will be impossible without a very stable and reliable energy supply. The mankind history can be thought of as the energy application history, and the

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conventional energy such as wood, fossil fuel, water energy, wind energy, and tidal energy play different role in different stage of development of human history. In the initial stage of human history, the total consumption of energy of human worldwide is a little due to the total number of human being is less and the very low productivity level. The wood is used as fuel accounts for a very important role, and the tidal energy, wind energy, and coal are used in a small scale. At present, we can still see tidal power, windmill, watermill mills and wind sailing boat hundreds of years ago all over the world, and the wood is the main fuel in the least developed countries. The total trend of energy structure has not a little change until the Industrial revolution in 1760s. The human history come into a rapid development stage since Industrial revolution, and the fossil fuel plays an important role, such as coal, natural gas and crude oil. The total consumption worldwide is ever-increasing demand with the increasing of human number and improving of productivity level. Recently, the total consumption per year of fossil fuel resources is more than billions of tons, which has bring a series of environment question like air pollution and water pollution and greenhouse gas and Global warming. The ever-increasing pressure of pollution and energy supply is driving society towards the research and development of alternative and renewable energy sources.

For an actual example, it is well known that China is the largest developing country in the world. Since 1978, Chinese government begins its open-door policy and economic reforms, China has experienced spectacular economic growth, and hundreds of millions of the ordinary people have been raised out of poverty [1]. At present China have become the world's second largest economy in 2010, and just behind USA, and the Gross Domestic Product (GDP) in 2010 has more than 5000 billion dollars. Certainly, the total energy consumption increases in an incredible speed, such as the energy consumption in 2010 has more than 3 billion tons standard coal. The ever-increasing energy demand bring a serious question like air pollution, water pollution, soil pollution, acid rain, and resource exhaustion, and so forth. When most of the Chinese people excites for the rapid development of economic and society, there are more than 118 resource-exhausted cities and involving a total population of 154 million. It is not only related to the fate of dozens of cities, and relate to the fate of more Chinese future decades of resource strategy, economic prospects [2]. At the same time, China's energy structure is very inappropriate as compare with the global energy structure. For example, global shares of oil, natural gas, coal and other in 2009 are about 34%, 24%, 30% and 12%, respectively [3]. The shares of oil, natural gas, coal and other in China are about 18%, 3.4%, 68.7% and 9.9%, respectively [4]. The fossil fuel resources have a share of 90% in past 30 years, and the dirty-burning coal has a share of 70%, which has brought great harm to the Chinese environment since 1978. The SO_2 emission from 2000 in China is more than 20 million tons, which ranks the first in the world [5]. The CO_2 emission is more than 4.5 billion tons, which ranks the second in the world [6]. The total pollution damage accounts for 10% of Chinese Gross Domestic Product [7]. As a conclusion, the unreasonable energy structure and energy consumption habit must be changed in all fields like building, industry production, transportation, and daily lifestyles of ordinary people to realize the sustainable development in future. Fortunately, China's central government and local governments have regarded the research and development of alternative and renewable energy resources in order to drive society towards the low carbon society. China's Renewable energy law has been established in 28 Feb, 2005, which has been implemented since 1 Jan, 2006. And the revision has been passed by 11th National People's Congress standing committee meeting in 12 times on 26 December, 2009, which has been implemented since 1 April, 2010 [8]. In this paper, firstly, the renewable energy application practices and policies in China are detailed described. Then, the policies are deeply deliberated in next section. Finally, the developmental barriers and recommendations are introduced, respectively.

2. Renewable energy application practice

At present, the renewable energy application is well developed status in the whole world such as wind energy, solar energy, tidal energy, geothermal energy, biomass energy, and so on. However, different renewable energy has different development situation in China due to those price and technology reasons. In this section, the distribution and different development situations are introduced.

According the statistical data of the third wind energy resource investigation, China's wind resources have been mapped by the China Meteorological Administration (CMA) wind and solar energy resources assessment center. Sites are classified based on the different wind speeds and wind energy density [11]. Normally, the wind energy regions in China can be divided into five resource bands, just as shown in Fig. 1 and Table 1. The abundant zone of wind energy includes the I, II, III, and IV bands which have a share more than 76% of land, where is the comparative efficient zone of wind energy application in China, and the wind energy density is about 200 W/m^2, and the annual accumulative hours is more than 4000. When wind speed is more than3 m/s and the annual accumulative hours is more than 2000 when wind speed is more than 6 m/s [9–12].

The development and utilization of the wind power in China is in rapid development stage, and the most important reason is that the price wind power is closed to the traditional energy

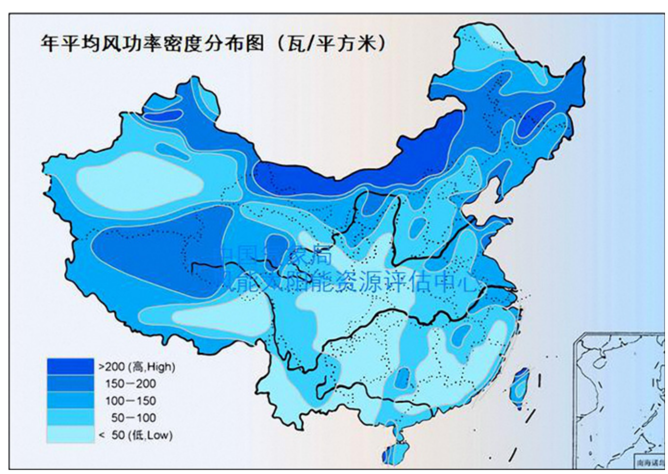


Fig.1. Distribution of wind energy resources in China (Source: [11]).

Table 1
Wind energy resource bands in China (Source: [9–12]).

Item	Wind energy	Energy density (W/m^3)	Accumulative hours (Speed$_{wind}$ ≥ 3 m/s)	Accumulative hours (Speed$_{wind}$ ≥ 6 m/s)
I	Best	> 300	> 7905	> 4000
II	Better	200~300	> 5000	> 2000
III	Good	> 200	5000~7000	3000
IV	Available	150~200	4000~5000	> 3000
V	Poor	< 50	< 2000	< 150

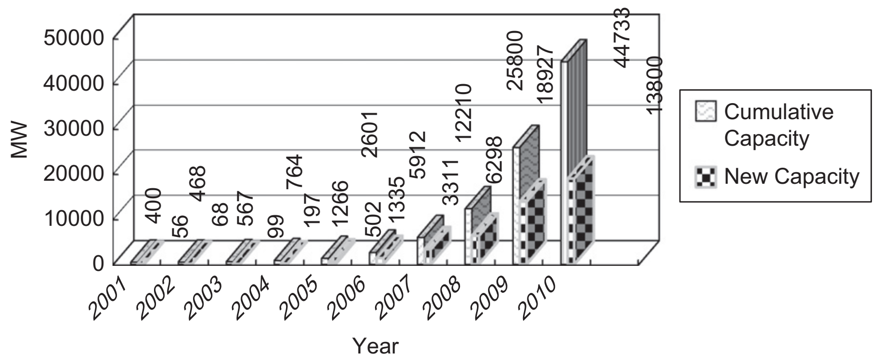


Fig. 2. Cumulative and new capacity of wind power in the past 10 years (source: [13–14]).

Table 2
Cumulative and new capacity of wind power in the past 10 years (unit: MW).

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Cumulative capacity	400	468	567	764	1266	2601	5912	12,210	25,800	44,733
New capacity	56	68	99	197	502	1335	3311	6298	13,800	18,927

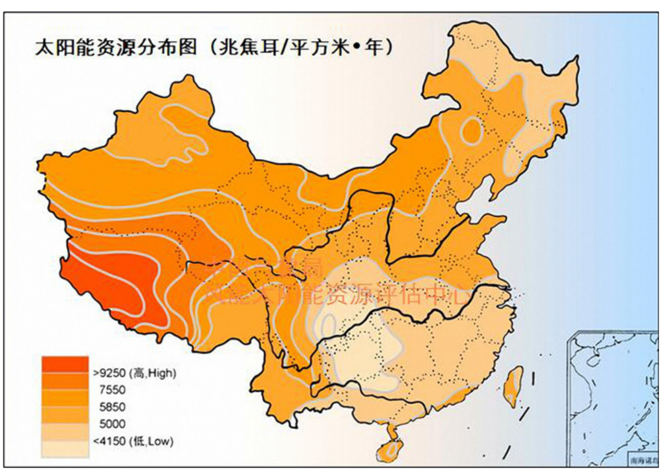


Fig.3. Distribution of solar energy resources in China (Source: [18]).

Table 3
Solar energy resource bands in China (Source: [15]).

Item	Radiation grade	Annual radiation quantity (MJ/m)	Daily radiation quantity (kWh/m)
I	Best	≥ 6680	≥ 5.1
II	Good	5850–6680	4.5–5.1
III	Ordinary	5000–5850	3.8–4.5
IV	Poor	4200–5000	3.2–3.8
V	Bad	< 4200	< 3.2

prices. For an example, the cumulative and new installed capacity of wind power in the past 10 years is shown in Fig. 2 and Table 2, and the annual growth rate is more than 100% from 2006 to 2009. The new installed capacity in 2010 is 13,800 MW which ranks the first in the whole world, and the total cumulative installed capacity ranks the second, and just behind USA [13,14]. Certainly, there are some other application practices such as wind energy mill, wind energy carry water system, and wind energy sailing, etc.

According to statistical data from China CMA wind and solar energy resources assessment center, the solar radiation regions in China can be divided into five resource bands, just as shown in Fig. 3 and Table 3. The abundant zone of solar energy includes the I, II, and III bands which have a share more than 67% of land, where is the comparative efficient zone of solar energy application in China, and the sunlight hours are more than two thousands, and the annual total amount of irradiation is more than 6 billion MJ/m^3 [11].

At present, the PV industry of China is in their rapid development stage in past 10 years. For example, the yield of Chinese PV in 2007 is more than 1200 MW, and which has share of 35% in whole world, and the yield in 2008 is more than 2000 MW, and which has share of 31% in whole world, and the yield in 2009 is more than 4000 MW, and which has share of 40% in whole world, and the yield in 2010 is more than 8000 MW, and which has share of 50% in whole world. The annual yield of PV in China ranks the first in the world form 2007. As shown in Fig. 4 and Table 4, the annual yield of PV in past 5 years is huge, and the annual growth rate is normally more than 100%. There are some worldwide big PV industries such as WuXi Suntech, BaoDing Yingli, and Hebei Jing-Ao, etc. At the same time, PV market in China is very small, and mostly used to the electric energy supply of remote villages, and some productions are used to the life of common citizens, such as solar energy street lamp, solar energy lawn lamp, and solar energy sight lighting, and so on. The amount of big connected grid PV generating station is little [16,17]. Certainly, the 2000 MW PV power station has been established in Erdos from 11, 2010, which is established in 2019 [18,19]. Furthermore, there are some other solar energy application practices such as solar energy water heater, solar energy greenhouse, solar energy house, and solar energy mill, and so on. Specially, China is the largest application and production country of solar energy water heater and the total accumulation amount is more than 100 million m^2 [17].

The geothermal energy resources in China have not been large-scale exploited commercially for heat or power generation. According to the latest statistical data from World Geothermal Congress 2010, the equipment capacity which can directly utilize geothermal energy amounts to 8898 MW. As can be seen from Fig. 5, the best geothermal resources distributed in southwest of China such as Tibet, Taiwan, and Yunnan. There are more than 3200 geothermal spots have been found in China, and the annual naturally relieved heat is more than 1.04×10^{17} KJ, i.e. 3.56×10^{9} tce. Normally, the geothermal resources in China can

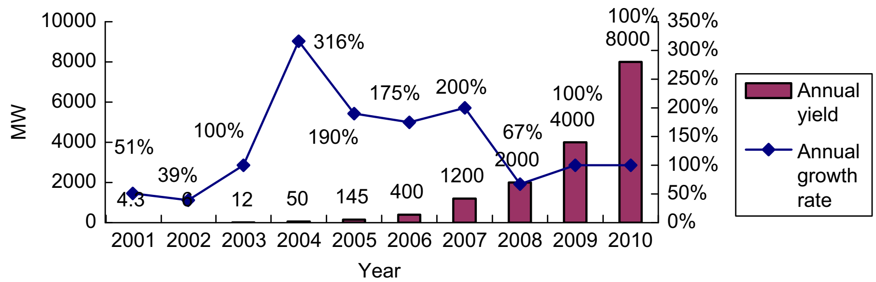


Fig. 4. Yield of solar cell in the last eight years (Source: [16–17]).

Table 4
Yield of solar cell in the last eight years (unit: MW).

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Annual yield	4.3	6	12	50	145	400	1200	2000	4000	8000
Annual growth rate (%)	51	39	100	316	190	175	200	67	100	100

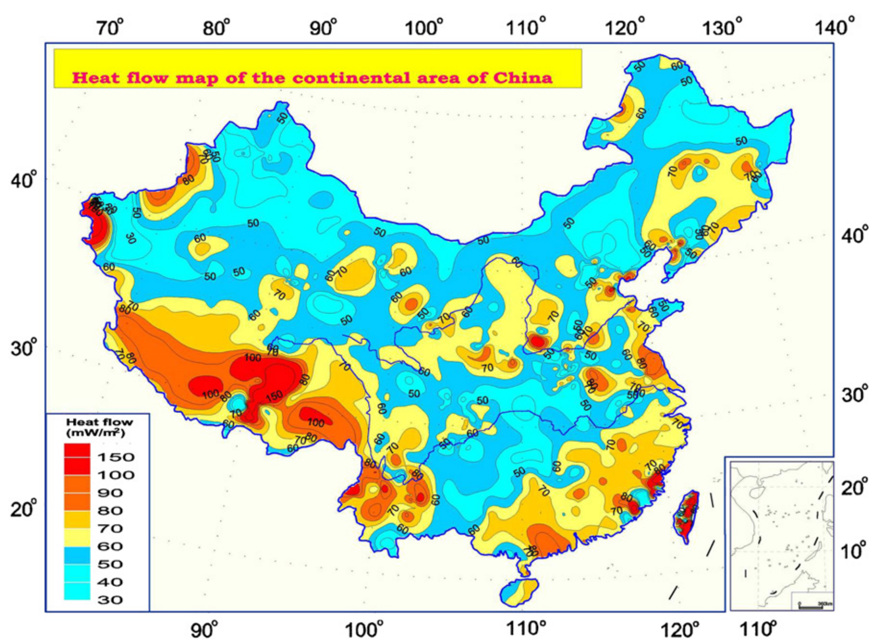


Fig. 5. Geothermal resources distribution in China (Source: [20]).

be divided into three categories: the high temperature convection type, the middle-low temperature convection type, and the middle-low temperature conduction type. Furthermore, the high temperature convection type distributed in Tibet, Tengchong, and Taiwan, and the temperature is generally more than 150 °C, and the middle-low temperature convection type distributed in Guangdong, Fujian, and Hainan, etc, and the middle-low temperature conduction type distributed in North China, Sichuan, and Inner Mongolia, etc. Here, the middle temperature is from 90° C to 150 °C and the low temperature is less than 90° C.

Geothermal energy application in China is abundant, which is widely applied in the heating system, such as bathroom, hotel, and public swimming baths, etc. Because of geothermal water is extracted the ground from deep underground, in addition to the high temperature, which often contain some special chemical element, so that it has a certain medical effect, and the curative effect of hot spring in China is widely exploited, and the annual customer is more than one billions. Geothermal energy is applied in agriculture, such as the use of suitable temperature geothermal water irrigation farmland, which can make the crop yield precocious. And the geothermal water can accelerate the mature of fish and improve the produce of the fish fattening rate. Furthermore, the geothermal energy power system has established in Yangbajing, Tibet [20–22].

China has abundant ocean energy resource, such as tidal energy, tidal current energy, wave energy, etc. But the actual application example is little. There are some universities and research institute design and manufacture some lab equipments, but the capacity is small and the efficiency is low [23]. Certainly, there are other application practices of biomass energy, such as biomass power station, and biomass oil. But the actual example in China is little because of the costly price.

As mention above, various renewable energies in China have different development status. Fortunately, Chinese central government has announced the China's renewable energy law in 2005. Furthermore, the low carbon economy and low carbon

society has been proposed by central government to realize the sustainable development in future, and there are some local governments have formulated their low carbon object in the next 10 years. As the world elsewhere, many low carbon objects have been established such as low carbon building, low carbon transportation, low carbon industry, etc [24–30].

At present, Chinese government has established the medium and long-term development plan, at the end of 2020. The installed capacity of hydropower will reach 300 million kW as compared with that of 225 million kW in 2011. The biomass power capacity will reach 30 million kW as compared with that of 5.5 million kW in 2010, and the biomass solid molding fuel will reach 50 million tons as compared with that of one million tons in 2010, and the methane amount will reach 44 billion cubic meters as compared with that of 19 billion cubic meters, and the bio-fuel ethanol amount will reach 10 million tons as compared with that of two million tons, and the bio-diesel amount will reach two million tons as compared with that of 200 thousand tons. The area of solar water heater will more than 300 million square meters as compared with that of 150 million square meters in 2010 [31]. The wind power capacities will more than 150 million kW in 2015 and 200 million kW in 2020, and the accumulative installed capacity in 2015 will more than 15 GW as compared with that of 2.2 GW in 2011 [32]. As a conclusion, the application and development of renewable energy in China will has a beautiful prospect in a foresee future.

3. Renewable energy policies in China

3.1. General principles

The renewable energy includes wind, solar, hydro, biomass energy, geothermal energy, and sea energy, etc. In order to promote the development and utilization of renewable energy, increase energy supply, improve the energy structure, safeguard energy security, protect the environment, realize the sustainable development of society and economy, the China's renewable energy law is established in 2005 and revised in 2009. The renewable law shall apply to China's territorial waters and territorial air space and territory. The development and utilization of renewable energy is viewed as the preferential energy development areas by China central government, and the development and utilization goals and total amount of renewable energy is formulated and took measures to promote the establishment and development of the renewable energy market. The governments at all levels encourage the development and utilization of renewable energy by various ownership economy main bodies, and protect the lawful rights and interests of investor. The national renewable energy development and utilization is unified managed by the country's energy department.

3.2. Resource survey and development planning

National energy department shall be responsible for the organization and coordination of the national renewable energy resources survey, and make technical specifications of resources survey. The energy department formulated the national development and utilization of renewable energy long-term total goal based on the energy demand and the actual conditions of national renewable energy resources, and submitted to the state council for approval before implementation, and promulgated. The organizational development and utilization planning of renewable energy shall consult the relevant units, experts and public opinion, and conduct the scientific demonstrations.

3.3. Industrial guidance and technical support

Standardization department of the state council formulates and publishes the national renewable energy power grid technology and other standards for the renewable energy technology and product of national standards. The development and utilization of renewable energy technology research and industrialization development is viewed as the national priority areas of science and high technology industries, and the capital support is arranged to demonstrate the application and industrialization development and promote the development and utilization of renewable energy technology progress and reduce the renewable energy production cost and improve the quality of products.

3.4. Popularization and application

The state encourages and supports the connected grid of renewable energy generation. Electric power enterprise purchases the full power renewable energy generation within range of power grid and provides grid services. The development of distribution renewable energy power system located in apart from the power grid area is supported by the all level governments to improve the life and electricity service. The development and utilization of clean and efficient biomass fuel, wind energy, solar energy are encouraged such as solar hot water system, and solar energy heating, refrigeration system, and solar photovoltaic power generation system, and stand-alone wind or solar power system has been used in many city communities and countryside.

3.5. Price management and cost allocation

The power price, connected with grid, is decided by the competent departments of price based on the different characteristic of renewable energy generation system and different area. And the electric power enterprise purchases full power of renewable energy generating system based on the price regulations of the state council. National finance set up special fund for renewable energy development, and some renewable and sustainable energy utilization projects have been promoted such as science and technology research, standard, demonstration engineering, and so forth. The financial institutions can provide preferential loans of Finance Discount for the development and utilization of renewable energy projects, certainly, which has been listed in the national renewable energy industry development guidance catalog according with credit conditions. The tax relief is given by country for the renewable energy industry development project which listed in the guidance catalog.

3.6. Legal responsibility

Local governments should obey the regulations to encourage the development of renewable energy, and electric power enterprise should purchase full power from renewable energy generation system, and oil sales enterprise should bring the biological liquid fuel according with state standards into its fuel sales system. If an illegal act, China's central government has established some punishments for the illegal behavior such as the responsible executives and other personnel directly responsible shall be given administrative sanctions, and if constitutes a crime, the offender shall be investigated for criminal responsibility.

4. Existing problems

Development and utilization of renewable energy in China made great achievements, and the regulations and policy system

is continuous perfect, but renewable energy development is still cannot meet the need of sustainable development, the existing problems include many field such as policy, economy, market, and technology, etc [33–34].

4.1. Policy field

In addition to the solar energy water heater and hydroelectric, other renewable energy product price and development cost is too high at current technology and policy situation. Furthermore, the distributed resources, small scale, discontinuous production and other characteristics result in the low competitiveness as compare with the conventional fossil fuel generation system. Although, the central government has established some incentive regulations such as tax and economy field, but the policy system is still not complete, economic incentives weak, relevant policy efforts lack of coordination, and poor stability, which did not form a long-term mechanism to support the sustainable development of renewable energy [33].

Furthermore, local governments located in different area in China have different incentive regulations, such as Shanghai is the most developed city, which located in eastern coastal of China, there are little fossil resources, but the energy demand is very great. Some incentive regulations have been formulated by Shanghai government in order to drive the development and application of renewable and sustainable energy such as tidal energy, wind energy, and solar energy and so on. For example, the renewable energy and related industrial research and development clearly is regarded as a strategic goal by Shanghai government to speed up the development and utilization of renewable energy and optimize the energy structure and protect the environment and realize the sustainable development of society and economy. At present, many actual applications examples of renewable energy have been used in Shanghai such as shore and off-shore wind power system, photovoltaic (PV) power system, tidal energy, PV building, hybrid wind-solar lighting, etc [35]. A contrary example, in the past half century, Shanxi province is the largest coal producing province in China, and the cost of environment and energy pay is great in the process of the development of energy economic. The pollution of rivers in Shanxi province have a share of more than 90%, and the ground collapse phenomenon very common in some area, which have affected the normal production and life of the common people, the essential reason is the large-scale of the coal mining in the past half a century. The investment is small due to the worse financial income level and technology level, certainly, the abundant coal resource is another important reason [36].

4.2. Market field

Long-term since, our country renewable energy development is lack of specific development goals, not form a continuous stable market demand. Although the national step by step for the development of renewable energy, but with no support established mandatory market security policy, unable to form stable market demand, renewable energy development lack of pulling, the market for our country renewable energy new technology development is slow.

For example, the development speed of PV industry in China is rapid in past 10 years, and the total production in 2010 is about 8000 MW and has a share of 50% in the world, but the total domestic installed capacity is only 380 MW, and the domestic market digests only less than 5% of total production, and which mostly used to the electric energy supply of remote villages and communication and solar energy manufacture and PV generating electric power [37]. Since 2005, China's total installed capacity of wind power realizes double growth. By the end of 2010, China's new wind power installed capacity is 16 million kilowatts, and the total accumulative installed capacity is 41.827 million kW, which are ranked the first in the world, and the grid wind power capacity is more than 31 million kW [38]. It is very clear that the domestic market of wind power is more than PV market, and the price is the most important reason. The grid electric price of wind power is about 0.1$/kWh as compare with the grid electric price of PV power is more than 0.3$/kWh at present. At the same time, it can be seen that the different renewable energy power production has different development stage and market situation.

4.3. Technology field

As the largest developing country, China has become the second economic entity in the whole world, and just behind USA. But the technological development ability and industry system is weak as compare with the developed country such as USA, Japan, Germany, etc. In addition to hydro, solar thermal utilization and biogas outside, other renewable energy technology level is low due to lack the technical research and development ability, and the equipment manufacturing ability is weak and technology and equipment production more rely on imports, certainly, the technical level and production capacity has big gap as compare with advanced level of developed country.

For example, the production process and technical standard and software program of Chinese wind power producers most come from wind power enterprise of Europe or the United States such as GE, Vestas, and Gamesa and so on. Unfortunately, although there are more than one hundred domestic wind power enterprises, but mostly of them has little core technology, and the mainstream technology is behind abroad about 10 years. At the same time, the personnel training very lag as compare with the rapid development of renewable energy industry. The support technical service system of renewable energy industry development has not formed at present [33].

4.4. International agreements field

At present, China's development is closely related with the development of the world. The Chinese renewable energy development, of course, also cannot get away from the development of the world. The renewable energy in the worldwide has been paid more attention, and more and more countries come into the field of the exploitation and application of renewable energy. Certainly, a serious of international agreements are proposed and established, such as Kyoto protocol, which has bring many obvious advantages such as the growth speed of greenhouse gas emissions in the past years becomes slow. However, there are some objections exist in the international agreements due to different countries have different developmental stage and different economic conditions. China is the largest developing country and the annual energy consumption ranks in the second in the whole world, and just behind of USA. Chinese central government and local governments regard the development of renewable energy such as wind power and solar power. But the unit energy consumption is about three times as many as the USA and is about five times as compare with that of Japan. The annual emission of CO_2 is about 6 billion of tons and ranks the first in the world. Certainly, in order to decrease the emission of greenhouse air, Chinese government have used some methods such as energy conservation, emission reduction using new technologies, and shut down the high energy consumption enterprise, and so on. But there are many difficulties for Chinese government such as numerous population and high energy consumption enterprise,

low level of science and technology. Chinese government is difficult to meet the international agreements in a short time.

4.5. Other questions

The technical standard, product testing, evaluation and certification system for renewable energy resources has not perfected. Renewable energy and insert system project construction lacks of uniform and reasonable planning in part area, and the engineering project existing unreasonable layout and disordered construction, and the renewable energy power planning and connected grid coordination of peak load regulating ability need to strengthen. In addition, the power grid planning and construction coordination mechanism of different investment subject needs to be improved. Partly power grid enterprises is not timely reform the power grid which cause renewable energy output restricted, and power loss [34].

As mention above, many questions existing in renewable energy power development process in China, certainly, with the regard of central government and local governments and ordinary people, these questions will be solved in foreseeable future, and the renewable and sustainable energy will face the rapid development stage.

5. Conclusion and recommendations

Firstly, this paper presents the current development situation of renewable and sustainable energy in China. Secondly, the application practice is introduced such as wind power, PV, and tidal power, etc. Thirdly, the renewable policies in China is detailed analyzed due to Chinese government and Chinese economy meets more and more energy pressure in future and the current rapid increased energy need, such as general principles, resource survey and development planning, industrial guidance and technical support, popularization and application, price management and cost allocation, and Legal responsibility, and so on. At present, some hortative policies have been formulated by central government and a local government due to China's government has formulated the sustainable and low carbon development model for economy and society. With the increasing price of energy and power, it can be predicted that the development and the application of renewable energy in China will rapid increase in foresee future. Consequently, in order to achieve the sustainable economy and society development it is important to regard the development and utilization of renewable resources, fortunately, Chinese central government and local governments have realized the importance of low carbon and sustainable development, and the large-scale development of renewable resources can decrease the carbon emission and increase the supply of clean energy. Furthermore, with the improving of technologies, the equipment price of renewable energy must be decreasing, and more and more clean power will come into ordinary people's home. In a word, renewable energy policy formulation for China in the development of renewable energy has the vital significance.

But there are some obvious questions during the renewable energy development, such as policy barrier, economy barrier, technology barrier, and market barrier, and so on. The existing questions have restricted the rapid development of renewable and sustainable energy. In order to realize the low carbon economy and society in future, it is important to solve those questions, certainly, which need the strongly fund support and policy support of central and local governments. The following measures are especially recommended in this regard:

(1) Must ensure the consistency of the central and local policies. There are more than 30 provinces in China, and the mover of local governments for renewable and low carbon energy development is different. In a way, the central government must be strictly required local governments all over formulated to encourage measures such as hortative policy, fund support, and tax reduction/exemption, etc. The low carbon industry, low carbon building, and renewable energy power project should been encouraged no matter in the cities or the countryside.
(2) The technology process is necessary to decrease the current costly price of renewable energy production, and the research fund for renewable resources should increase in different domains such as PV power, solar energy thermal, wind power, tidal power, tidal current power, biomass energy, etc. Furthermore, the fund support of machinery manufacturing, material technology, power electronic technology and intelligent control theory which related with renewable energy utilization should been increased.
(3) Abundant researcher should be launched into the interrelated research domain of renewable and low carbon energy. Certainly, the research in universities and graduate schools should be encouraged, and the relevant professional course and personnel training should also start. Furthermore, enterprise and university cooperation should be strengthened in order to improve the research level. For example, enterprise's specialized technical personnel training can be completed by universities, and college related professional practice can be completed in enterprise.
(4) The domestic market must expand to accommodate domestic production such as PV cell, MW wind power system, and solar water heater, etc. Certainly, it needs the support of government.
(5) Strengthen the international exchange and cooperation, and completes the interpretation work, and to promise, in the shortest possible time to achieve international agreements, of course, this requires the Chinese government do a lot of work, including technological innovation, capital support, tax cuts and international cooperation, etc. That is, Chinese government should improve the current energy structure and as far as possible to reduce the greenhouse air emissions in the short term. In order to achieve this goal, it is necessary that the advanced technology of renewable energy of developed countries should be imported. And high pollution and high energy consumption enterprise should be closed.

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